REVIEW OF THE APPLICATION OF SULPHUR RECOVERY GUIDELINES IN ALBERTA

DISCUSSION PAPER FOR STAKEHOLDER CONSULTATION

SEPTEMBER 1999

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REVIEW OF SULPHUR RECOVERY GUIDELINES
DISCUSSION PAPER FOR STAKEHOLDER CONSULTATION

1.0 Introduction

1.1 Purpose of the Discussion Paper

The Alberta Energy and Utilities Board in cooperation with Alberta Environment has initiated a review of the application of Alberta sulphur recovery guidelines as currently described in Informational Letter 88-13 and the related report ERCB-AE 88-AA (collectively referred to as IL 88-13 hereafter). The purpose in initiating the review is to clarify how the guidelines apply to older sour gas plants and to other facilities where sour or acid gases are handled. Such clarification is required for fair and consistent application of the existing guidelines.

More specifically and as described in General Bulletin 99-10, the objectives of the review were established to update and/or clarify:

- **the sulphur recovery requirements for grandfathered sour gas plants,**
- **the application of the sulphur recovery guidelines to other facilities, and**
- **the proliferation guidelines for small gas plants and other facilities.**

This document does not represent a draft position of the Board's or Alberta Environment's decisions on the matters to be addressed. Rather, this paper has been prepared as part of an ongoing commitment by the Board and Alberta Environment to multistakeholder consultation. It is intended to assist public and industry stakeholders in providing input and recommendations to the Board and Alberta Environment. The discussion paper provides background on the issues, as well as a discussion of alternatives that could be considered.

The scope of the review does not include revision of the current sulphur recovery guideline values, nor does it include development of sulphur recovery guidelines for power station (electric generation) flue gas streams.

1.2 Background on Current Sulphur Recovery Guidelines

The Sulphur Recovery Guidelines for Sour Gas Plants in Alberta, issued in August 1988 as IL 88-13, described sulphur recovery guidelines for **new** sour gas plants. The guidelines **were not** retroactively applied to gas plant approvals in effect at that time, therefore the existing sulphur recovery approvals were *"grandfathered"*. The decision to grandfather existing sour gas plants was made having regard for the cost that would be imposed on the industry to upgrade the facilities relative to the perceived benefits and the expected remaining operating lives of the plants.

The guidelines were technology based and designed to focus on pollution prevention and continuous improvement. Based on the latest ambient air quality guidelines and acid deposition target loads in the Province of Alberta, environmental protection is currently being achieved. However, reduction in emissions to the greatest practicable level remains appropriate.

The IL 88-13 guidelines for sulphur recovery in new sour gas plants are summarized in Table 1.

Table 1: Sulphur Recovery Guidelines for Sour Gas Plants

Inlet Sulphur Rate	Sulphur Recovery[1]
1 to 5 tonnes/day	70%
5 to 10 tonnes/day	90%
10 to 50 tonnes/day	96.2%
50 - 2,000 tonnes/day	98.5 - 98.8%[2]
> 2,000 tonnes/day	99.8%

1) Deduct 0.3% for quarterly average requirements.
2) Recovery = 98.18185 + 0.187259 $\log_{10}$(Inlet Sulphur Rate).

Both Alberta Environment and the EUB have regulatory responsibilities for many of the facilities that are covered by the sulphur recovery guidelines. Under its legislation, Alberta Environment may set more stringent sulphur emission limits for specific facilities where warranted than those resulting from the EUB's application of the sulphur recovery guidelines. The results of this review are not intended to limit Alberta Environment's responsibilities or authorities in that regard nor with respect to any enforcement actions required to ensure compliance with EPEA approvals.

While IL 88-13 did not require that existing plants be upgraded if their operations remained unchanged, the IL did state that upgrading of grandfathered plants would be required if:

- the capacity of the facilities were increased or
- if new sour gas connections significantly extended plant life

IL 88-13 states that:

> "Consideration was given to the need for higher recoveries when existing plants are modified. It has been decided that the new requirements should apply when a capacity expansion of greater than 25 per cent is made or when a substantial process modification is made at an existing plant. The above is intended as a general rule. In some cases, particularly at older plants which do not currently meet the requirements of IL 80-24, an expansion of less than 25 per cent could result in some upgrading of sulphur recovery being required, although not necessarily to the new requirement set out in this report.
>
> Also, concern has been raised that newly discovered gas reserves are being connected to older plants with lower sulphur recovery and thus technological advances and new recovery requirements are not being applied. AE and the ERCB believe that processing new gas through existing plants is not only sound from an economic viewpoint but also in terms of environmental impact. They would thus not wish to unduly inhibit this practice. However, they agree that it would be undesirable to allow this practice to result in substantially higher sulphur emissions in the province. Accordingly, where substantial new sour gas volumes which were not recognized in the original plant approval, are connected to an existing plant, the new sulphur recovery requirements will

be imposed. It is difficult to quantify the actual volumes because they will be decided on a case-by-case basis by AE and the ERCB and hence may vary. However, in general, if the volumes are sufficient to satisfy a new plant of similar capacity to the existing plant for a period of 8 to 10 years, then the new sulphur recovery requirements will apply. As in the case of a capacity expansion, where new gas is connected to a plant with a recovery efficiency much lower than the new requirements, some upgrading of sulphur recovery efficiency may be required even if the new gas is not as significant as described above."

It was intended that IL 88-13 be used as a guideline for situation specific determination of sulphur recovery requirements. The IL also provided for the review of the performance of grandfathered plants with the potential, following review, that upgrading could be required if judged appropriate.

1.3 Guiding Principles for this Review

The following are intended to be the guiding principles for the results of this review:

1. **The sulphur recovery guidelines will be clearly defined, easily understood and consistently applied.**

   The current guidelines require a significant degree of interpretation by the Board and by industry. This outcome would provide greater certainty for all stakeholders, including the public, regarding Board decisions on the need for sulphur recovery.

2. **The application of the sulphur recovery guidelines will balance consideration of the potential public and environmental benefits with potential costs, including impacts on resource recovery.**

   IL 88-13 was based on a balance between economic and environmental goals. The Board expects that recommendations arising from the review will also be justified in terms of potential benefits (economic and environmental) and costs to all stakeholders.

3. **The application of the sulphur recovery guidelines will be based on precautionary principles.**

   Available information indicates that ambient air quality guidelines for sulphur emissions, including acid deposition target loads, are being met in Alberta at current emission levels. It is expected that the review will therefore focus on the precautionary principle of minimizing emissions of all potentially harmful substances to the extent practical, even in the absence of specific evidence of adverse impacts.

1.4 Explanation of Review Objectives

In GB 99-10, the Board set out three objectives for its review of the sulphur recovery guidelines.

1.4.1 Clarify Sulphur Recovery Requirements for Grandfathered Gas Plants

Since 1988, the gas industry has continued to find new gas supplies and enhance reserves recovery. In turn, this has tended to extend the life expectancy of older sour gas plants. A trend to maximize the use of the existing sour gas processing infrastructure by significant extensions of sour raw gas pipelines has been noted. This trend has the effect of extending

the life of these plants through the addition of new reserves. However, these additions of new gas, often occur in relatively small increments. While the ultimate result is often a significant extension of plant life, individual step changes, in themselves, are usually not sufficient to trigger a review of the original plant approvals unless such additions are considered in total. Therefore, a large element of professional discretion needs to be exercised.

It is also noted that efforts by industry to maximize utilization of its sour gas processing capital investments is resulting in emerging trends of third-party gas processing and "mid-stream" businesses. In general, such optimization of capital assets is felt to be in the public interest, as is the associated reduction in the numbers of new sour gas plants. However, these trends to improved utilization of existing sour gas processing plants also tend to increase throughput and again extend the life of the grandfathered sour gas plants.

The issue has been raised by the public that if grandfathered plants continue to have a significant remaining life, these facilities should be upgraded to IL 88-13 standards. While IL 88-13 clearly anticipated such a requirement, the provisions of IL 88-13 with respect to the circumstances where upgrading of a grandfathered gas plant would be expected are interpretive, often complex and difficult to administer. Consequently, there is uncertainty for both industry and the public as to what conditions need to be in place before upgrading would be required.

1.4.2 Clarify the Application of Sulphur Recovery Guidelines to Other Facilities

Since its inception, IL 88-13 has become the benchmark for sulphur recovery expectations for sour and acid gas streams, not only in sour gas plants but also in other upstream and downstream petroleum industry facilities. IL 88-13, however, was originally intended to apply **only** to sour gas plants. There are no clear requirements as to the appropriate application of the guidelines to other facilities. Thus, this review will determine how the sulphur recovery guidelines should apply to other energy facilities such as oil and gas batteries, compressor stations, refineries and heavy oil upgraders.

Note: It is recognized that sulphur emissions from power plant boilers, as well as upgrader boiler stacks have not typically been addressed using IL 88-13 as a benchmark. However, the technology contemplated in the IL is not suitable for removing sulphur from flue gases. In order to properly identify sulphur dioxide emission reduction requirements in flue gas from power boilers and upgrader operations, an assessment of the capabilities, costs and benefits of flue gas desulphurization technology is required. Such an assessment is beyond the scope of this review. However, the Board recognizes that a broader review of emissions minimization technology, including the associated environmental benefits and economic implications, would facilitate a fair allocation of acidifying emissions control requirements across source types and would support such a review in the future.

1.4.3 Clarify Proliferation Guidelines for Small Gas Plants and Other Facilities

The sulphur recovery guidelines incorporate thresholds for the implementation of sulphur recovery and incremental increases in removal requirements that are based on the sulphur content of the feed streams in tonnes/day (refer to Table 1). These thresholds, in the absence of controls on facility proliferation, could potentially create an economic incentive to implement a greater number of sour gas plants with inlet sulphur rates just below key levels. This situation could result in higher total sulphur emissions, greater land use for sour facilities and greater adverse public impacts.

The Board notes that there has been a tendency for development of small sweetening plants in the 0.5 to 0.99 tonne/day sulphur inlet range over the past 10 years. Plants with less than 1.0 tonnes/day sulphur inlet are not required to recover sulphur and can avoid the related capital and operating costs. Therefore, any change in the sulphur recovery guidelines must fully consider the implications on plant and facility proliferation.

1.5 Review Process

The review of the sulphur recovery guidelines has been planned to enable broad stakeholder input on what changes should be considered in meeting the objectives discussed in Section 1.4. The following section describes the proposed review process.

1. EUB and Alberta Environment staff have prepared a discussion paper (this document) designed to provide background information to stakeholders and to identify a range of potential alternatives. The paper will be posted on the EUB's website and will be made available in print form to interested parties on request.

   It should be noted that the discussion paper does not contain any data on the relative economic impacts of the various options. It is expected that these will be established to a large degree through the consultation process.

2. A multi-stakeholder advisory group of industry and non-governmental organization representatives will be formed to assess the various options available and to provide its assessments of the relative costs and benefits. Staff from the EUB and Alberta Environment will provide support to the advisory group and assist them in their deliberations as required.

3. In parallel to this process, all other stakeholders will also be asked to respond to the discussion paper by letter, fax or e-mail with their comments and recommendations. These could include any actions the EUB and Alberta Environment should take to address the objectives noted in Section 1.4. In order to assist staff in evaluating and reporting on input received, the following information should be supplied with responses.

   a) Name, address (mail or e-mail), telephone number and organization or business affiliation.

b) The recommended approaches, including alternatives not discussed, that the EUB and Alberta Environment might take and/or discussion of concerns regarding the alternatives suggested in this document.

c) Comments and supporting information on the potential benefits and costs of recommended approaches. In particular, information that would be particularly useful to the review would include:

   i) feedback on the capital and operating cost impacts of upgrading or installing sulphur recovery at grandfathered facilities;

   ii) information on how these costs would affect ultimate recovery of sour gas reserves; and,

   iii) information on how increased sulphur recovery would benefit adjacent landowners and the surrounding environment.

At this time, it is anticipated that not less than 2 months (60 days) would be adequate for responses but this time frame can be amended if required. On that basis, stakeholder responses to this discussion paper are requested by December 15, 1999.

4. Input received from both general stakeholders and the advisory group will be reviewed and summarized into a single, publicly available report. Where necessary, additional work will then be carried out by the EUB and/or Alberta Environment to further confirm the benefits, costs and resource recovery impacts of related actions.

5. Based on both the public input and its own analysis, the Board, in consultation with Alberta Environment, will release its findings as an Informational Letter with the associated reports provided as background information.

Feedback and inquiries regarding this discussion paper should be directed to the attention of Kim Eastlick, P.Eng. as follows.

Mail: Alberta Energy and Utilities Board
640 – 5 Avenue SW
Calgary, Alberta
T2P 3G4

Fax: (403) 297-3520

e-mail kim.eastlick@eub.gov.ab.ca

2.0 Grandfathering and Sour Gas Plant Sulphur Recovery

Plant approval and historical operating data available in May 1999 formed the basis of this section of the discussion paper. Information used included: the EUB's plant approvals database (EUB Statistical Series 99-50); S-30 report data (monthly sour gas plant sulphur balances); and sulphur emission data recorded by Alberta Environment for acid gas flaring plants (i.e., plants that do not have sulphur recovery).

Sixty-one grandfathered sour gas plants with sulphur recovery at levels less than those specified for new plants in IL 88-13 were reviewed. This included 33 plants that have

sulphur recovery facilities (sulphur recovery plants) and 28 plants approved for more than 1 tonne/day sulphur inlet but which do not have sulphur recovery facilities (i.e., acid gas flaring plants).

2.1 The Significance of Grandfathered Sulphur Recovery Plants

The grandfathered sulphur recovery sour gas plants that were considered are listed in Table 2.

Table 2: Grandfathered Sour Gas Plants with Sulphur Recovery

Location (Twp - Range)		Field	Plant Operator	Approved Sulphur Inlet (tonnes/d)	Actual Average 1998 Sulphur Inlet (tonnes/d)	Approved Quarterly Sulphur Recovery	IL 88-13 Quarterly Recovery at Approved Sulphur Inlet (Note 1)	IL 88-13 Quarterly Recovery at 1998 Average Sulphur Inlet (Note 2)	Approved Sulphur Emissions (tonnes/d)	Average 1998 Sulphur Emissions (tonnes/d)
37	10W5	Strachan	Husky	4,660.5	2,292.6	98.1%	99.5%	99.5%	88.50	30.59
59	18W5	Kaybob South	Chevron	3,630.0	877.6	98.1%	99.5%	98.4%	69.00	13.73
4	30W4	Waterton	Shell	3,148.0	2,011.1	98.7%	99.5%	99.5%	41.00	25.27
28	1W5	Crossfield East	Amoco	1,833.6	480.5	98.0%	98.5%	98.4%	36.60	6.30
26	0	Crossfield	Cdn. Oxy.	1,730.5	395.6	98.0%	98.5%	98.4%	34.50	6.49
60	15W5	Windfall	Amoco	1,356.1	622.3	98.3%	98.5%	98.4%	23.10	12.09
62	20W5	Kaybob South	Amoco	1,107.7	429.2	98.4%	98.5%	98.4%	17.70	6.01
37	9W5	Strachan	Gulf	971.4	287.3	98.1%	98.4%	98.3%	18.40	3.47
25	5W5	Jumping Pound	Shell	619.4	450.7	96.2%	98.4%	98.4%	22.40	15.39
19	28W4	Okotoks	Dynegy (Note 3)	587.0	269.8	98.3%	98.4%	98.3%	9.95	4.09
30	7W5	Burnt Timber	Shell	579.6	413.1	98.5%	98.4%	98.4%	19.60	9.46
53	18W5	Edson	Talisman	350.0	124.6	97.9%	98.4%	98.3%	7.40	3.69
26	5W5	Wildcat Hills	Petro-Can	287.5	120.6	97.5%	98.3%	98.3%	7.20	2.12
74	12W6	Sinclair	AEC	261.7	72.1	97.7%	98.3%	98.2%	5.00	0.99
34	26W4	Wimborne	Ulster	235.0	148.7	95.5%	98.3%	98.3%	10.60	5.88
54	15W5	Resevoir	Suncor	178.9	66.0	95.6%	98.3%	98.2%	7.90	1.51
29	28W4	Lone Pine Creek	Mobil	165.3	131.8	98.0%	98.3%	98.3%	3.30	2.25
109	8W6	Rainbow	Husky	149.5	79.0	95.0%	98.3%	98.2%	7.45	3.10
44	1W5	Hemeglen-Rimbey	Gulf	137.5	68.5	92.0%	98.3%	98.2%	10.00	4.73
63	25W5	Simonette	Suncor	120.0	69.2	96.5%	98.3%	98.2%	4.20	2.22
46	14W5	Brazeau River	Gulf	119.5	60.7	92.1%	98.3%	98.2%	9.50	3.45
54	15W5	Resevoir	Suncor	115.8	37.0	94.6%	98.3%	95.9%	6.30	1.41
69	22W5	Sturgeon Lake South	Poco	104.2	35.8	94.0%	98.3%	95.9%	6.20	2.10
67	5W6	Gold Creek	Rio Alto Expl.	100.0	51.4	97.0%	98.3%	98.2%	3.00	1.70
116	6W6	Zama	Novagas	80.4	17.3	92.0%	98.2%	95.9%	6.40	1.02
30	2W5	Carstairs	Home	72.2	13.2	90.0%	98.2%	95.9%	7.40	1.11
78	10W6	Progress	Union Pacific	51.2	28.2	96.5%	98.2%	95.9%	1.73	0.50
44	12W5	Brazeau River	Gulf	49.7	39.0	93.5%	95.9%	95.9%	3.24	1.98
46	6W5	Minnehik-Buck Lake	Penn West	39.7	28.2	94.5%	95.9%	95.9%	2.20	1.02
74	4W6	Teepee	Talisman	25.0	17.0	92.0%	95.9%	95.9%	2.00	0.86

			(Note 4)							
57	21W4	Redwater	Imperial	12.2	3.6	(Note 5)	95.9%	89.7%	1.20	0.17
35	6W5	Caroline	Amoco	11.3	8.9	92.0%	95.9%	89.7%	0.91	0.64
34	4W5	Caroline	Amoco	10.1	7.0	85.0%	95.9%	89.7%	1.53	0.91
Totals		**Plants 33**		**22,900.5**	**9,755.6**				**495.4**	**176.0**
Note 1:		Based on the approved sulphur inlet, this is the quarterly sulphur recovery that would be required if the sulphur requirements								
		as outlined in IL 88-13 for new plants, were applied.								
Note 2:		Based on 1998 average sulphur inlet, this is the quarterly sulphur recovery that would be required if the sulphur recovery requirements,								
		as outlined in IL 88-13 for new plants, were applied.								
Note 3:		Annual approved sulphur recovery efficiency.								
Note 4:		Talisman @ Teepee has been approved to implement an acid gas injection scheme.								
Note 5:		Imperial @ Redwater has a fluctuating recovery rate based on sulphur inlet.								

Approved sulphur emissions from the 33 grandfathered sulphur recovery plants totals 495 tonnes/day. However actual 1998 emissions were 176 tonnes/day. Comparison of current approvals with IL 88-13 quarterly sulphur recoveries at approved sulphur inlet rates suggests that elimination of grandfathering would reduce approved emissions by 255 tonnes/day or 51%. Based on actual 1998 sulphur inlet rates however, the potential reduction in sulphur emissions would only be about 64 tonnes/day or 36%. Thus, while the potential to reduce sulphur emissions by ending grandfathering appears significant on the basis of plant approval information, analysis of operating data suggests that potential reductions in actual sulphur emissions would be significantly less at current operating levels.

It is also noted that several of the grandfathered sulphur recovery plants, on the basis of average 1998 sulphur inlet and plant performance, currently already approach or exceed IL 88-13 sulphur recovery levels. When actual 1998 operating data are taken into account, however, 13 plants potentially would not need sulphur recovery facilities under IL 88-13 and the potential reduction in emissions would be 27 tonnes/d.

2.2 The Significance of Grandfathered Acid Gas Flaring Plants

The grandfathered sour gas plants without sulphur recovery (e.g., approved to flare acid gas) are listed in Table 3.

Table 3: Grandfathered Sour Gas Plants without Sulphur Recovery

Location (Twp - Range)		Field	Plant Operator	Approved Sulphur Inlet (tonnes/d)	Actual Average 1998 Sulphur Inlet (tonnes/d)	Approved Quarterly Sulphur Recovery	IL 88-13 Quarterly Recovery at Approved Sulphur Inlet (Note 1)	IL 88-13 Quarterly Recovery at 1998 Average Sulphur Inlet (Note 2)	Approved Sulphur Emissions (tonnes/d)	Average 1998 Sulphur Emissions (tonnes/d)
64	13W5	Virginia Hills	Shell	9.80	5.67	0.0%	89.7%	89.7%	9.80	5.67
43	4W5	Wilson Creek	Petro-Can	7.60	4.01	0.0%	89.7%	89.7%	7.60	4.01
59	11W5	Whitecourt	Petro-Can	7.50	2.79	0.0%	89.7%	89.7%	7.50	2.79
64	19W5	Kaybob	Petro-Can	5.15	1.58	0.0%	89.7%	89.7%	5.15	1.58
59	9W5	Greencourt	CNRL	5.08	2.92	0.0%	89.7%	89.7%	5.08	2.92
15	22W4	Vulcan	Crestar	4.90	1.93	0.0%	89.7%	89.7%	4.90	1.93
41	13W4	Killam	AltaGas	4.80	2.70	0.0%	89.7%	89.7%	4.80	2.70
42	16W4	Forestburg	Signalta	4.50	3.39	0.0%	89.7%	89.7%	4.50	3.39
64	11W5	Judy Creek	Pengrowth	3.60	1.89	0.0%	89.7%	89.7%	3.60	1.89
44	17W4	Strome	Sceptre	3.40	1.77	0.0%	89.7%	89.7%	3.40	1.77
41	12W4	Bellshill Lake	Archean Energy	3.15	2.10	0.0%	89.7%	89.7%	3.15	2.10
30	21W4	West Drumheller	Vintage	2.99	1.33	0.0%	89.7%	89.7%	2.99	1.33
51	8W5	Bigoray	Amoco	2.96	1.60	0.0%	89.7%	89.7%	2.96	1.60
77	6W6	Spirit River	Norcen	2.60	0.62	0.0%	89.7%	0.0%	2.60	0.62
45	20W4	Bittern Lake	CNRL	2.48	0.81	0.0%	89.7%	0.0%	2.48	0.81
86	13W6	Boundary Lake South	Pioneer	2.20	0.77	0.0%	89.7%	0.0%	2.20	0.77
12	18W4	Retlaw	Northstar	1.92	1.02	0.0%	89.7%	89.7%	1.92	1.02
85	13W6	Boundary Lake South	Rigel	1.90	0.70	0.0%	89.7%	0.0%	1.90	0.70
37	3W5	Sylvan Lake	Ocelot	1.85	0.43	0.0%	89.7%	0.0%	1.85	0.43
42	5W5	Wilson Creek	Imperial	1.68	1.16	0.0%	89.7%	89.7%	1.68	1.16
31	4W5	Harmattan-Elkton	Home	1.66	0.37	0.0%	89.7%	0.0%	1.66	0.37
14	18W4	Little Bow	Crestar	1.60	0.70	0.0%	89.7%	0.0%	1.60	0.70
66	27W4	Big Bend	CNRL	1.50	0.41	0.0%	89.7%	0.0%	1.50	0.41
53	20W5	Ansell	Ranger	1.40	0.69	0.0%	89.7%	0.0%	1.40	0.69
13	17W4	Enchant	ANG	1.25	0.39	0.0%	89.7%	0.0%	1.25	0.39
50	25W4	Leduc-Woodbend	Imperial	1.01	0.63	0.0%	89.7%	0.0%	1.01	0.63
17	12W4	Bantry	Beau Canada	1.00	0.62	0.0%	89.7%	0.0%	1.00	0.62
61	12W5	Carson Creek	Mobil	1.00	0.59	0.0%	89.7%	0.0%	1.00	0.59
			Totals	**90.48**	**43.59**				**90.48**	**43.59**
Note 1:		Based on the approved sulphur inlet, this is the quarterly sulphur recovery that would be required if the IL 88-13 guidelines for new plants were applied.								
Note 2:		Based on 1998 average sulphur inlet, this is the quarterly sulphur recovery that would be required if the IL 88-13 guidelines for new plants were applied.								
		Some grandfathered acid gas flaring plants would not be required to recover sulphur (e.g., 0% recovery) where 1998 sulphur inlets are less than 1 tonne/d.								

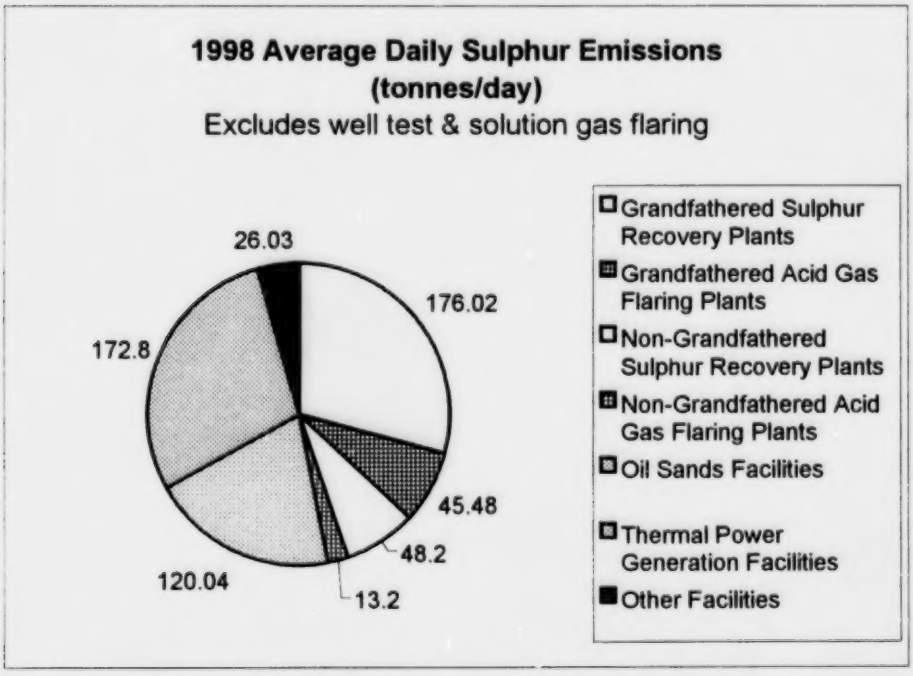
On the basis of approved sulphur inlet, implementation of sulphur recovery at the 28 grandfathered acid gas flaring gas plants would reduce approved emissions from 90 tonnes/day to 20 tonnes/d, a reduction of 70 tonnes/day or 77%. When actual 1998

operating data is taken into account, however 13 plants might not need sulphur recovery facilities and the potential reduction in emissions would be 27 tonnes/day.

2.3 Comparative Sulphur Emissions for All Sectors

As a part of this review, it was felt to be important to compare the sulphur emissions from all sectors of the province in order to fully comprehend the issue of grandfathering sour gas plants. Figure 1 illustrates 1998 sulphur emissions by major sources in the province. This comparative analysis considers sulphur emissions data compiled by the EUB and Alberta Environment for sour gas, acid gas, final product, and flue gas streams. However, due to limitations of available data, it does not include the 1998 sulphur emissions from sour gas well testing and solution gas flaring.

Figure 1: 1998 Sulphur Emissions by Major Sources
(average tonnes/day)



In 1998, the grandfathered sulphur recovery plants were in aggregate the largest sulphur emitters in the Province, producing 176 t/d. The second largest sulphur emitters were the seven coal fired power generation facilities in the Province with 173 t/d of sulphur emissions. Oil sands facilities were collectively responsible for 120 t/d of sulphur emissions. Over 75% of these emissions were contributed by Syncrude. Non-grandfathered sulphur recovery and acid gas flaring plants contributed approximately 48 and 13 t/d of sulphur emissions respectively. Other facilities, which includes petrochemical, refining, cement, pulp and paper, fertilizer, acid gas injection, and gas fractionation facilities, were responsible for 26 t/d of sulphur emissions in 1998. Approximately 45% of these emissions were contributed from the five oil refineries in the province.

3.0 Discussion of Alternatives for Grandfathered Sour Gas Plants

A range of techniques exists to address the grandfathering issue. These range from allowing the older approvals to continue with out change, to ending grandfathering at some near-term date. The following sections present few possible management alternatives in order to help stakeholder discussion and feedback on the issue.

3.1 Scenario 1: Sunset Date for Grandfathered Approvals

A "sunset" approach in its simplest form would set a date by which grandfathered plants must be either be upgraded or decommissioned. This alternative could involve a defined end to grandfathering at some specified future date along with suitable rules to address interim approaches for capacity expansions. Industry companies would need to review each of their grandfathered plants to determine which facilities, based on the companies' longer term business strategies, should be upgraded and which should be decommissioned.

Under this scenario, the target date for ending provisions for grandfathering could be set far enough in the future to facilitate collaborative industry review and plant rationalization. The target date could also consider timing required to design, obtain approvals, construct and commission upgraded sulphur recovery facilities.

One model of the sunset date scenario is set out in the following.

1. All sour gas plants with approved inlet sulphur rates greater than 1 tonne/d could be required to comply with the sulphur recovery guidelines listed in Table 1 by 1 January 2005.
2. Grandfathered plants required to upgrade per Item 1 above would have the option of changing approved inlet sulphur rates to better reflect the current expected peak capacity utilization. The sulphur recovery guidelines listed in Table 1 could apply to the revised inlet sulphur rate.
3. In the interim, grandfathered sour gas plants could be expected to upgrade to comply with Table 1 if approved inlet sulphur capacities were increased by more than 25% above rates approved in 1988. If the expansions were approved, the upgraded sulphur recovery facilities would have to be operational before throughput could be increased.

3.2 Scenario 2: Limits on Remaining Life

As noted earlier, IL 88-13 did not impose new sulphur requirements on existing sour gas plants, in part on the assumption that without significant additions of new gas, most were approaching the end of their economic life. Where supply additions significantly extended service lives, it was expected that the plants would be upgraded and IL 88-13 sets out provisions for when this is to occur. Recent experience has shown that in fact many plants appear now to have a much longer economic life than was previously anticipated. Therefore, it may be more appropriate to use the overall remaining life of the grandfathered plants rather than the significance of incremental sour supply connections to define upgrading requirements.

The following possible scenario could result in clearer requirements without imposing costly upgrades on older plants with declining supply sources.

1. Grandfathered plants with a supply life index[1] greater than eight years would be expected to achieve sulphur recovery as per Table 1.

   a) Operators would be expected to evaluate the status of grandfathered plants and submit to the EUB, by 1 July 2000, a report summarizing the need for upgrading.

      i) Plants with a supply life index greater than eight years as of 1 July 2000 would be expected to comply with sulphur recovery guidelines listed in Table 1 by 1 July 2003.

      ii) Operators of plants with a supply life index of less than eight years would be expected to produce, on request of Alberta Environment or the EUB, their evaluation and supporting information justifying ongoing grandfathering.

   b) On a go forward basis, operators could be expected to provide an evaluation of the effect of new supply tie-ins to the plant on the supply life index. In the event that new supply connections result in a supply life index of greater than eight years, then the plant would be required to comply with the sulphur recovery provisions of Table 1 within two years of the approval date for the new supply connections.

   c) The evaluations could be based on raw recoverable sour gas reserves and approved raw gas capacity as this basis would more closely address remaining plant life than an alternative based on sulphur reserves and approved sulphur inlet rates.

1. Grandfathered plants required to upgrade per Item 1 above could have the option of changing approved inlet sulphur rates to better reflect expected peak capacity utilization. The sulphur recovery guidelines listed in Table 1 would apply to the revised inlet sulphur rate.

2. Grandfathered sour gas plants could be expected to upgrade to comply with Table 1 if approved inlet sulphur capacities were increased by more than 25% above rates approved in 1988. If expansions were approved, the upgraded sulphur recovery facilities would have to be operational before throughput could be increased.

3. The Board's proliferation policy would be clarified to discourage construction of new sour gas plants where, in the Board's view, the new plants are intended to avoid upgrading grandfathered plants that are otherwise suitable for processing the related gas reserves.

3.3 Scenario 3: Limits on Increasing Throughput

The sulphur capacity approvals for several grandfathered gas plants are significantly higher than actual throughput. These grandfathered approvals could allow the plants to process

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1 Where plant life index would be defined by the following relationship:
Index (years) = (remaining recoverable raw gas reserves connected to the plant in 10^3m^3) ÷ (365 x approved plant inlet capacity in $10^3m^3/d$)

substantial additional sour volumes, with associated increases in emissions, without any requirement for regulatory review or improved sulphur recovery. It is also not necessarily in the public interest that the existence of such significant underutilized grandfathered capacity provides a potential competitive advantage for such plants over newer plants that were not grandfathered.

Defining the need for upgrading of sulphur recovery in terms of new reserves additions or remaining plant life is potentially complex, highly interpretive and administratively difficult. A simpler alternative would be to continue to grandfather plants in declining throughput situations and require upgrading only if new supply connections significantly increase capacity utilization.

This concept would see the approved inlet sulphur rate of all grandfathered gas plants to be changed to better reflect actual plant utilization. Once this has occurred, any significant increase in throughput would require an application and upgrading of sulphur recovery at the plant. For example, the trigger might be an increase in throughput of 25% or greater above the lesser of the 1998 or the previous year's average daily sulphur inlet (possibly excluding periods of shutdown greater than 7 days).

The following conditions describe one example of how such an approach could be implemented:

1. The EUB could revise approved sulphur inlet for grandfathered gas plants on an annual basis to 125% of the average daily sulphur inlet (excluding periods of shutdown greater than 7 days) in the previous calendar year or 125% of the 1998 calendar year average daily sulphur inlet, whichever is less.
2. Operators could be expected to upgrade sulphur recovery of grandfathered gas plants in compliance with Table 1 if new supply connections or other initiatives increased sulphur inlet by more than the approved maximum daily sulphur inlet set per Item1.0.
    a) An application would be required for increases in the approved sulphur inlet, as determined in Item 1 above, according to the provisions of EUB Guide 56 (Energy Development Application Guide and Schedules).
3. The Board's proliferation policy would be clarified to discourage construction of new sour gas plants where, in the Board's view, the new plants are intended to avoid upgrading grandfathered plants that are otherwise suitable for processing the related gas reserves.

3.4 Scenario 4: Continued Grandfathering

The Board believes that as an alternative, permitting ongoing grandfathering of older gas plants should also be considered. As noted earlier, based on current understanding, routine SO_2 emissions from grandfathered gas plants are not known to cause ambient air quality or acid deposition problems if the plants are operated in compliance with approval conditions. It could be argued that there might not be a significant environmental need for requiring that grandfathered plants be upgraded.

The following approach would simplify upgrading requirements related to grandfathering to only situations of significant approved capacity expansion.

1. Grandfathered sour gas plants could be expected to upgrade to comply with Table 1 if approved inlet sulphur capacities were increased by more than 25% above rates approved in 1988. If expansions were approved, the upgraded sulphur recovery facilities would have to be operational before throughput could be increased.
2. Current sulphur recovery and maximum inlet sulphur approvals could continue in effect as long as Alberta Ambient Air Quality Guidelines were met.
3. The Board's proliferation policy would be clarified to discourage construction of new sour gas plants where, in the Board's view, the new plants are intended to avoid upgrading grandfathered plants that are otherwise suitable for processing the related gas reserves.

4.0 Application and Enforcement of the Sulphur Recovery Guidelines

Stakeholders are invited to provide feedback on the following approaches and input on other options that may be considered relevant for applying and enforcing the guidelines.

4.1 Annual and Quarterly Requirements

The sulphur recovery levels in Table 1 have been used to set quarterly and, more recently, annual requirements in sour gas plant approvals. The recoveries listed in Table 1 are guidelines for design and normal operations capability, where as the quarterly values provide some allowance for upsets and other non-routine conditions (e.g., turnarounds and start-ups). Two alternatives are provided for comment with respect to application of the annual and quarterly sulphur recovery values.

1. The sulphur recovery values listed in Table 1 would be used to set annual approval requirements. Those values less 0.3% would be used to set quarterly sulphur recovery requirements. The EUB would monitor and enforce both annual and quarterly approval requirements.

   or

2. The sulphur recovery values listed in Table 1 would be used in approvals to set target recovery for normal operations. Operators would be expected to demonstrate that facility design, maintenance and operating strategies are sufficient to sustain the target values under normal operations. Approvals would also specify quarterly recovery requirements (Table 1 values less 0.3%) that the EUB would monitor and enforce.

4.2 Enforcement

The EUB expects operators to consistently meet their quarterly sulphur recovery approvals and it currently monitors sulphur recovery on a calendar year quarter basis. Consistent with the Board's generic enforcement ladder, failure to meet specified quarterly sulphur recovery levels results in escalating consequences.

Currently, if a quarterly sulphur recovery target is missed. EUB staff will request that the plant superintendent describe in writing the causes of the non-compliance and explain what actions will be taken to ensure future quarters are met. If sulphur recovery

approvals are not met for two quarters in a 12-month period, EUB staff will meet with the operator's **senior** operating and technical personnel to review operations and actions taken to correct the non-compliance. In addition to the meeting with the operator's senior staff, the EUB will notify the operator that failure to meet approved sulphur recovery levels for another quarter in the next 12-month period will result in a reduction in approved plant inlet capacity or a suspension of the plant approval.

It would be the Board's intent to continue to apply its enforcement ladder as described in the foregoing. Any changes to facility sulphur recovery approvals that arise out of this review would be enforced in a similar manner.

4.3 Upstream Petroleum Industry

Sections 4.3.1 and 4.3.2 describe some options as to how the sulphur recovery guidelines could potentially be applied to all upstream petroleum facilities, including sour gas plants. For the most part these reflect current practice for new facilities, as well as changes introduced with EUB Guide 60 (Upstream Petroleum Industry Flaring Guide). Stakeholders are invited to review the sections and provide comments, concerns and any recommendations for improvements.

4.3.1 Sour Gas Plants

For sour gas plants, new and amended EUB approvals could be based on the sulphur recovery guidelines listed in Table 1 (as discussed in Section 4.1) subject to the decisions on grandfathering provisions for plants approved prior to 1988.

Sulphur recovery would be calculated based on the sulphur recovered, divided by the sulphur contained in the combined inlet stream, less any sulphur remaining in plant product streams (e.g., sour condensate). Flared sour or acid gas would be included in overall quarterly sulphur recovery evaluations.

4.3.2 Batteries, Pipeline Stations and Other Facility Types

Certain types of gas gathering and non-associated gas battery facilities can result in significant sulphur emissions. Emissions may originate from flaring of low pressure produced water flash gas and from flaring of glycol dehydrator vent gas. EUB Guide 60 defines sulphur recovery guidelines for oil and gas batteries, compressor stations and gas dehydration facilities. The following paragraphs are consistent with, and further explain related provisions that could be implemented in order to create broader consistency with Guide 60.

In approving an acceptable level of sulphur emissions from sour gas flaring facilities, the following criteria would be considered:

1) The flaring of sour gas at gas batteries and gathering facilities in sour gas production systems (e.g., well through gas plant) that results in substantial SO_2 emissions (e.g., greater than 1 tonne/d sulphur) will generally not be permitted.

2) As a minimum, the sulphur recovery guidelines listed in Table 1 will apply to all sour gas streams continuously flared at gas gathering and gas battery facilities.

a) In situations where the bulk gas stream is not processed for H_2S removal, sulphur recovery requirements and emissions limits will be determined based on the sulphur content of the low pressure sour gas streams separated within the facilities that would otherwise be flared. The recovery requirement will be based on the H_2S content of the stream in question and not the overall sulphur in the facility inlet stream. For example, if a sour water stream is separated in a facility and sour vapours are released when the water is reduced to storage pressure, then the need for and level of sulphur recovery would be determined on the sulphur content of the sour vapour stream.

b) For facilities that do not currently submit S-30 (sulphur balance) reports, approvals will specify limits on the flared gas H_2S content and on the total amount of sour gas flared per quarter that will be consistent with expected recovery levels. This approach will allow the use of the S-2 and S-8 reports to monitor compliance and to avoid additional reporting for such facilities. This approach recognizes that the "recovery" method typically used is injection of high pressure sour water (no flash gas stream is produced) or compression and injection of the low pressure stream into the facility outlet gas stream. The effective recovery approach would provide a limited allowance for flaring the sour gas streams during upsets and maintenance outages.

3) Certain batteries, compressor stations and other upstream facilities may need to be approved as gas processing plants. Gas processing plants are defined by Section 1.1 of the Oil and Gas Conservation Act as "*a plant for the extraction from gas of hydrogen sulphide, helium, ethane, natural gas liquids or other substances but does not include a well head separator, treater, or dehydrator.*" Under this definition any facility that includes an amine or sweetening process is a gas plant and must be approved as such by both Alberta Environment and the EUB. Any sour gas plant that proposes to emit more than 2.8 tonnes/day of sulphur is a Mandatory Activity on Schedule 1 of the EPEA Environmental Assessment (Mandatory and Exempt Activities) Regulation (Alberta Regulation 111/93) and requires an environmental assessment as part of the Alberta Environment approval process.

   a) It is EUB practice to exempt production facilities from classification as gas processing plants, if they are recovering less than 2 m^3/day of hydrocarbon liquids via refrigeration or are removing small amounts of sulphur (less than 0.1 tonnes/day) by using non-regenerative scavenging chemicals that have no H_2S or SO_2 air emissions.

   b) Alberta Environment must be consulted with respect to approval requirements for gas sweetening processes. Facilities that process raw gas to separate or remove sulphur compounds are classified as sour gas plants by the Alberta Environmental Protection and Enhancement Act and require approval from Alberta Environment.

4) The foregoing provisions apply to all new facilities and to significant modifications of existing facilities effective 1 January 2000.

   a) Operators must review by 1 July 2000 sulphur recovery at battery and pipeline facilities (e.g., upstream petroleum facilities other than gas plants) approved, prior

to 1 January 2000, to flare greater that 1 tonne per day sulphur. Such facilities will be expected to meet the requirements noted in Item 2) above by 1 July 2003.

4.3.3 Acid Gas Injection

Acid gas injection, where appropriate and technically feasible would continue to be an alternative to sulphur recovery. Under normal operating conditions the effective recovery of acid gas injection would be 100%. However it is recognized that equipment problems can result in acid gas flaring and associated sulphur emissions. Effective 1 January 2000, EUB approvals for acid gas injection schemes would limit flaring of sour and acid gas such that the effective sulphur "recovery" of the schemes meet the guidelines listed in Table 1. Furthermore it would be expected that acid gas injection schemes would normally have substantially better effective sulphur recovery than applicable Table 1 guidelines. It would be expected operational features and equipment redundancy would be installed to minimize the need for flaring.

EPEA approvals issued by Alberta Environment limit the duration of flaring events in acid gas injection systems as follows:

- up to 24 hours, flaring permitted up to 100% of approved acid gas rate;
- up to 48 hours, flaring permitted up to 50% of approved acid gas rate;
- up to 72 hours, flaring permitted up to 25% of approved acid gas rate; and,
- in excess of 72 hours, facility must be shut-in.

It should be noted that, in order that the Alberta Ambient Air Quality Guidelines for SO_2 can be met, EUB Guide 60 may place further limits on the duration of acid gas flaring in situations where stacks are not of sufficient height.

4.4 Industrial Facilities and Downstream Petroleum Industry

Section 4.4.1, describes how it is proposed to apply the sulphur recovery guidelines to industrial and downstream petroleum facilities. For the most part these reflect recent EUB decisions and approvals for such facilities that have used IL 88-13 as a benchmark for sulphur recovery expectations. Stakeholders are invited to provide feedback and recommendations on the proposed approach.

The sulphur recovery guidelines have not been applied to flue gas streams from coal fired power generator boilers and refinery/heavy oil upgrader boiler streams. The rationale for not including these SO_2 sources in the sulphur recovery guidelines is discussed in Section 4.4.2.

4.4.1 Application to Acid and Sour Gas Streams in Downstream Plants

The technical requirements to accomplish the recovery of sulphur from sour gas and acid gas streams generated in refineries, heavy oil upgraders and other industrial facilities are substantially similar to those for sour gas plants. However, a significant fraction of sulphur contained in the inlet stream may also be contained in the final product streams or in the flue gas streams (e.g., coker CO boiler flue gas). Thus, it would not be appropriate to set sulphur recovery based on inlet sulphur in these facilities.

It is proposed that the sulphur recovery guidelines be applied to refineries, heavy oil upgraders and other industrial facilities on the following basis.

1) The "recovery basis" for determining the need for, and level of, sulphur recovery in refineries, heavy oil upgraders and other industrial facilities subject to EUB approvals would be the total sulphur content of all sour gas and acid gas streams generated within each facility, including the sulphur content of streams used as sour fuel or flared.

2) Petroleum refineries, heavy oil upgraders and other industrial facilities subject to EUB approvals will be expected to meet the sulphur recovery guidelines listed in Table 1. Annual and quarterly recoveries could be specified on the basis discussed in Section 4.1. Recovery would be determined on the recovery basis defined in Item 1) above, including sulphur emitted during emergency flaring of sour or acid gas.

3) Approvals in effect as of 1 January 2000 will be grandfathered in the same manner as sour gas plants. It is proposed that grandfathering will be limited on the same basis as is ultimately decided for sour gas plants (see Section 3.0).

4) It is recognized that refineries and upgraders are complex facilities that may require special sulphur recovery provisions for extended start-up periods or sulphur recovery system maintenance. It may not be in the public interest to require such facilities to curtail throughput or shutdown during limited term periods of lower recovery. Therefore the Board and Alberta Environment could consider, on a case by case basis, applications that involve limited allowances in overall sulphur recovery levels for start-up and maintenance. In such situations, the onus would be on applicants to demonstrate that increased emissions during such events would not result in exceedances of the Alberta Ambient Air Quality Guidelines.

    a) Any allowance would be based on limited duration conditions. It would be expected that facilities design, operating strategies, maintenance plans and catalyst replacement schedules would be implemented so that the specified approval sulphur recovery levels can normally be sustained.

4.4.2 Application to Flue Gas Sulphur Emissions

The Board recognizes that sulphur and other acidifying emissions that have the potential to adversely affect the environment are not solely generated by the upstream petroleum industry. However, the sulphur recovery guidelines described in IL 88-13 are based on technology applicable for the recovery of H_2S from sour gas streams and the processing of acid gas to recover sulphur. Both the appropriate pollution abatement technology and the pollutants to be addressed in generating stations can be quite different from those encountered in sour gas plants. For the most part, the technologies assessed in the development of IL 88-13 are not applicable for recovery of sulphur from flue gas streams. Therefore, the sulphur emissions in flue gas from electrical generating stations and refinery/upgrader boilers have not been included in this review.

To date the assessment of technology appropriate for controlling emissions from utility generating stations has been done on a national basis with Federal regulatory agencies

(Environment Canada and Health Canada), other provinces, the Canadian Electrical Association, equipment suppliers and environmental non-government organizations.

At this time, emission requirements are specified in the Federal Department of the Environment document "Thermal Power Generation Emissions – National Guidelines for New Stationary Sources". Further, Environment Canada, the provinces and the affected electrical utilities are taking actions to implement the recommendations outlined in the multi-stakeholder report on "Strategic Options for the Management of Toxic Substances from the Electric Power Generation (Fossil Fuel) Sector".

It is noted that the Clean Air Strategic Alliance (CASA) has established a working group to address NO_x-SO_2 abatement issues. The CASA working group has representation from the power generation industry, CAPP, environmental non-government organizations and regulators. It is viewed that the CASA process may be the more appropriate domain for assessing the need for more comprehensive emissions controls at power plants.

5.0 Proliferation Guidelines for Small Gas Plants and Other Facilities

Application of the sulphur recovery guidelines listed in Table 1 could potentially result in an economic incentive for the proliferation of smaller, lower (or zero level) sulphur recovery plants. This may be exacerbated by further limitations on grandfathered gas plant approvals. Such proliferation could result in higher net sulphur emissions and greater land use impacts than would be the case if production, pipeline and processing infrastructure were optimized.

The following are proposed revisions and clarifications to EUB policies with respect to facilities proliferation as described in Guide 56, Volume 2 and in IL 91-01 (Applications for Approval of Gas Processing Schemes – Policy on Plant Proliferation). Stakeholders are invited to comment and make recommendations with respect to the proposed approach for addressing proliferation issues, and to propose other options

5.1 General Philosophy

The Board would expect that operators contemplating development of new sour production facilities would consider alternatives involving the use of existing facilities where feasible. Under current EUB requirements, operators are required to thoroughly explore all reasonable options to use or modify existing facilities before applying for new construction. The Board would expect that, on request, applicants would provide detailed documentation of their evaluation of the technical, environmental, economic and other factors related to the decision to construct new facilities.

5.2 Proliferation Guidelines

The following items describe proposed approaches to address proliferation issues.

1) Operators must demonstrate that all existing facilities in the area, that afford technically viable alternatives, regardless of ownership or interest, have been contacted and assessed. To preclude the unnecessary development of new facilities, it is

expected that applicants will also evaluate the feasibility of upgrading existing facilities and/or forging commercial partnerships with existing operators. It would be expected that operators would pursue alternatives that maximize sulphur recovery and minimize environmental impacts. It is noted that high processing fees, in and of themselves, may not be considered sufficient grounds for rejecting the option to use an existing facility as EUB legislation provides for the review of facility processing fees.

2) Operators proposing construction of new sour gas facilities must assess the area's future production potential to ensure the proposed facility is designed to meet the area's longer-term oil or gas processing and handling needs. The evaluation must consider all inactive commercial wells in the area with a view to inviting these well owners to participate in the new facility in some manner.

3) The Board expects operators to cooperate in the development of new area production, pipeline and processing infrastructure, especially where sour gas is involved. The lack of existing facility alternatives does not relieve operators of the obligation to cooperatively seek out development approaches that minimize emissions, as well as land use and public impacts.

4) The Board may require area operators to prepare and submit area development plans if, in the view of the Board, proliferation and/or overall area development issues have not been adequately addressed in individual applications.

5) In the event that operators propose construction of new facilities where alternatives exist, the Board may require that sulphur recovery in the new facilities be at least equivalent to the level that would be achieved if existing facilities were used. That is, the new facilities would be required to achieve a sulphur recovery equivalent to the greater of:

    - the level set out in the sulphur recovery guidelines for the proposed plant inlet sulphur rate; or,
    - the approved sulphur recovery level set out for existing plant(s) in the area that would be reasonable alternatives for processing the sour gas.

6) In the event where multiple non-recovery (e.g., less than 1 tonne/day sulphur inlet) or low sulphur recovery gas plants are proposed for a newly developing area that could be served by fewer plants with higher sulphur recovery, the Board may set individual plant sulphur recovery requirements on the basis of the total sulphur contained in area production.

7) In general, the Board would not expect to see sour gas plants located within 10 kilometres of each other.

8) In considering proliferation issues the Board would place priority on minimizing emissions and other adverse environmental and land use impacts. In industry disputes involving two or more facility alternatives with similar environmental and public impacts, the Board would generally not intercede if the choice between the alternatives is solely related to economic aspects of potential proliferation.